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DESCRIPTION OF MIOCENE MAMMALIA.

WITH FOUR PLATES.

By O. C. MARSH.

Description of Miocene Mammalia; by O. C. MARSH.
(With Plates VII-X.)

THE object of the present article is to figure and to describe more fully a number of interesting remains of mammals which have already been named and briefly noticed by the writer. These specimens are mainly from the Rocky Mountain region, but a few were found on the Atlantic coast, in New Jersey, and, owing in part to this fact, it becomes possible for the first time to establish approximately in the Miocene a horizon common to the two regions.

Protoceras celer, Marsh.*

The type specimen of this genus and species is represented, one-half natural size, in the two figures on the accompanying plate, number VII. Figure 1 represents the skull seen from above, and showing on the parietal bones (*p*) the diminutive horn-cores (*h*) that suggested the generic name. The suture (*s*) between the parietals and frontals (*f*) is very distinct in the specimen, and is clearly shown in the figure. The median elevation on the posterior part of the frontals is also well marked. The depression (*a*) in the maxillary is likewise a noticeable feature in this view of the skull.

In figure 2 of Plate VII, the same skull is represented as seen from below. This view shows the dentition to be ruminant in type, with the premolars all unlike the molars. The posterior nares (*n*) are noteworthy for their forward position.

The most interesting points in this type specimen were given by the writer in the original description above cited. The new genus *Protoceras* was shown to represent a distinct family, which was named the *Protoceratidæ*. Some characters seen in the type specimen suggested affinities with the Giraffes, and this fact was stated in the description.

In the following year, 1892, Dr. J. L. Wortman discovered several specimens of *Protoceras* in the same region where the type was found, and later Prof. H. F. Osborn and Dr. Wortman published an important paper on the genus, with figures, based upon this material.† These specimens proved that the type was the skull of a female, and that the male skull had, in addition to protuberances on the parietals, a pair

* This Journal, vol. xli, p. 81, January, 1891.

† Bull. Amer. Mus., vol. iv, p. 351, 1892.

of elevations on the frontals, and a third pair on the maxillaries. With these were elongated canine tusks. The structure of the feet, also, was determined.

The horizon was subsequently stated to be a distinct one, just above the *Oreodon* beds, and was named by Wortman the "Protoceras beds."

In the Palæontology of von Zittel (vol. iv, pp. 405-407), figures of the type specimen of *Protoceras* are given, reduced from the original drawings represented on Plate VII of the present article; also figures of the male skull and the feet, taken from Osborn and Wortman's paper.

Elothierium crassum, Marsh.*

The type specimen of the present species was discovered by the writer in August, 1870, in the lower Miocene of Colorado, but was not described until 1873. It was found associated with a skeleton of *Brontotherium*, and thus its horizon was definitely determined. A second specimen was seenred in the immediate vicinity, and in the same stratum. Researches in the same region during several succeeding years brought to light a number of other specimens, including several skulls and portions of the skeleton of this and other allied species.

Explorations begun by the writer in 1874, in Nebraska and Dakota, resulted in finding several additional specimens, and others have since been obtained in the same region during the explorations made for the U. S. Geological Survey. Still other very perfect specimens have been seenred by the Yale Museum, so that now ample material is available for investigating both the present species and its near allies.

On Plate VIII of this article is represented, one-eighth natural size, a skull of *Elothierium crassum*, which is one of the most perfect ever discovered. The lower jaws are in place, and the nearly complete dentition is present and in fine condition. Figure 1 shows this skull as seen from the left side, with the jaws slint closely together, as found. One of the most noticeable features is the long dependent process (*m*) on the malar bone, which in this species extends downward to the inferior margin of the lower jaw, in front of the angle. This is the case when these processes are somewhat expanded transversely, as shown in figures 2 and 3, which represent the skull as it lay in the matrix. Another peculiar feature shown in figure 1 is the series of processes on the lower jaw, the first (*a*) being the dependent, everted angle of the ramus; the second (*b*) a protuberance under the third lower premolar; and the third (*c*) a process below the base of the canine. These processes are well shown, also, in figure 3.

* This Journal, vol. v, p. 487, June, 1873.

Seen from above, in figure 2, the most noteworthy features are the small space occupied by the brain in the parietal region (*p*), the widely expanded malar processes (*m*), and the narrow, elongated facial portion. In this figure, the lower jaw is not represented. In figure 3, which shows the skull and lower jaws in position and seen from in front, many interesting points are shown. Copies of the original drawings of figures 1 and 2 will be found in von Zittel's Palæontology, Vol. IV, p. 337.

The feet of *Elotherium* have hitherto been known only imperfectly from fragmentary portions, but the extensive material already referred to has enabled the writer to make out their entire structure in the present species. In figures 4 and 5 of Plate VIII, the manus and pes are represented, one-sixth natural size. It will be seen that in each foot there are only two functional digits, corresponding to the third and fourth in man. The first digit is entirely wanting, and only remnants remain of the second and fifth.

Elotherium clavum, sp. nov.

On Plate IX, figure 1, is shown a skull of *Elotherium*, with the brain-cast in position, which agrees in many respects with the skull figured on the preceding plate, and described above. When first figured, the former skull was referred to *E. crassum* (Dinocerata, p. 65, 1884), but a more careful comparison proves it to be distinct. It is considerably smaller than *E. crassum*, and the malar process is quite slender and tapering below. It extends directly downward, and hence is not seen in the top view of the skull. The length of this skull is sixteen inches, measured from the front of the premaxillaries to the back of the occipital condyles. The dentition agrees, in the main, with that of *E. crassum*, the last lower molar in each having four cones only, and no heel. The malar arch and the dependent angle of the lower jaw will distinguish it from *E. Mortoni*. The type specimen here figured is from the Oreodon beds, near the White river, in southern Dakota.

Ammodon Leidyanum, gen. nov.

The teeth represented on Plate IX, figures 2 and 3, indicate a very large animal belonging to the same group as those last described, but differing in several respects. The first tooth, shown in figure 2, is the type specimen of *Elotherium Leidyanum*, already described by the writer.* It is the fourth premolar of the right lower jaw, and was found in 1867, in a Miocene deposit in Monmouth county, N. J.

* Proc. Phila. Acad., vol. xxii, p. 3; and Geology of New Jersey, p. 740, 1868.

The tooth represented in figure 3 is the last right molar, and was found at the same locality under circumstances which render it probable that it may have pertained to the same animal. The premolar agrees closely in form with the corresponding tooth in *Elotherium*, but the last lower molar, shown in figure 3, has, in addition to the four cones characteristic of *Elotherium*, a distinct fifth posterior cone, or heel, not present in typical specimens of that genus. The two genera represent a distinct family, which may be called the *Elotheridae*.

Ammodon (Elotherium) bathrodon.*

The type of the present species is the tooth shown on Plate IX, figure 4. It is the last lower molar of the right side, and, in its main features, agrees with the corresponding tooth last described. It indicates an animal somewhat smaller, but far exceeding in size most members of the group. Since this type specimen was described, two or three skulls of the same species have been secured by the writer, all found in the Miocene of Dakota, in the same general region where the type was discovered. These skulls agree in their general features with that of *Elotherium* figured on Plate VIII, but the brain-case is proportionately larger, and the processes on the lower jaw are still more developed. The dependent angle of the lower jaw slopes backward, and not forward as in *Elotherium crassum*. The lower molar teeth, also, all have a posterior lobe more or less developed, and the last lower molar has a distinct heel. In one of these skulls, the space occupied by the upper premolar and molar teeth is twelve inches, and the space across the palate between the true molars is two and one-half inches.

Ammodon potens, sp. nov.

The present species is somewhat smaller than the one last described, and differs in having a proportionately more elongate skull and less robust teeth, especially in the molar series. All the lower true molars have a distinct posterior cone, and this is nearly as well developed on the first and second molars as on the last. The processes on the lower jaw are more elongate than in any other species of the group. The dependent process on the malar is also especially elongate. The space occupied by the lower premolar and molar series is twelve inches, and by the premolars alone seven and one-half inches. The depth of the lower jaw from the base of the canine to the end of the process below is seven and one-half inches, and the distance from the top of the fourth premolar to the end of the middle process below is seven inches.

The type specimen of the present species is from the Miocene of Colorado.

* This Journal, vol. vii, p. 534, May, 1874.

*Perchærus (Dicotyles) antiquus.**

On Plate X, figure 1, is shown a last upper molar tooth, which may be provisionally referred to the genus *Perchærus* of Leidy. It is from the Miocene of Monmouth county, N. J., from the same locality where was found the lower molar tooth described by the writer as *Dicotyles antiquus*, and the two may be referred to the same species. The tooth is especially noteworthy in itself from the complicated structure of its crown, which approaches that seen in the existing suillines. The lower molar tooth, the type of the species, has a crown of simpler structure, and may be distinct.

Colodon luxatus, Marsh.†

The type specimen of the present genus and species is represented in part on Plate X, figures 2 and 3, which show the entire dentition of the lower jaw. In the original description cited above, it was shown that the present genus is probably nearly allied to *Lophiodon*, but could be readily distinguished from it by two inner cones on the upper premolars, and by the absence of canines in the lower jaw. The same characters and the presence of a posterior lobe on the last lower molar will separate it from *Hyrachyus*. The type specimen is from the Miocene of South Dakota.

Rhinoceros matutinus, Marsh.‡

The lower molar tooth represented on Plate X, figure 4, is from the Miocene of Monmouth county, N. J., and was found in the same horizon and locality as the other specimens from New Jersey described above. Its main interest lies in this fact, the significance of which will be discussed later. The tooth is the last lower molar of the right side, and while the species appears to be distinct, the tooth agrees in its general structure with the corresponding molars of allied forms from the Rocky Mountains.

All the type specimens above described are preserved in the Yale Museum. These remains have a special interest when considered in connection with the localities in which they were found. Those from the West are from three definite horizons in the Miocene, lying one above the other on the eastern flank of the Rocky Mountains. Those from the Atlantic coast are all from a single horizon in the same formation, and this

* Proc. Phila. Acad., vol. xxii, p. 11, 1870.

† This Journal, vol. xxxix, p. 524, June, 1890.

‡ Proc. Phila. Acad., vol. xxii, p. 3, 1870.

horizon, too, may now be sharply defined. The deposits containing the remains from New Jersey here described, and other vertebrate fossils obtained by the writer at the same or adjoining localities, form a well-defined stratum resting unconformably upon the Eocene greensand marls of Monmouth county, N. J. These Miocene deposits may be called the Ammodon beds, from the largest land animal hitherto found in them. So far as at present can be determined, this horizon corresponds most nearly to that in the Rocky Mountain region in which *Ammodon bathrodon* has been found. This subject will be disussed by the writer in a later communication.

Yale University, New Haven, Conn., October 24, 1893.

EXPLANATION OF PLATES.

PLATE VII.

FIGURE 1.—Skull of *Protoceras celer*, Marsh; seen from above.

FIGURE 2.—The same skull; seen from below. Both figures one-half natural size.
a, depression in maxillary; *f*, frontal; *h*, horn-core; *m*, first molar;
n, posterior nares; *o*, orbit; *p*, parietal; *pm*, second premolar; *s*,
 suture between frontal and parietal.

PLATE VIII.

FIGURE 1.—Skull of *Elotherium crassum*, Marsh; side view.

FIGURE 2.—The same skull; seen from above.

FIGURE 3.—The same skull; front view. These figures are one-eighth natural size.
a, angle of lower jaw; *b*, protuberance on margin of lower jaw;
c, process below canine; *f*, frontal; *m*, malar process; *mx*, maxillary;
n, nasal; *p*, parietal; *pm*, premaxillary; *s*, squamosal.

FIGURE 4.—Left fore foot of *Elotherium crassum*; front view.

FIGURE 5.—Left hind foot of same species; front view. Both figures are one-sixth natural size.
a, astragalus; *c*, calcaneum; *R*, radius; *U*, ulna; *II-V*, digits and remnants of digits.

PLATE IX.

FIGURE 1.—Skull of *Elotherium clavum*, Marsh, with brain-cast; top view. About one-fifth natural size.

FIGURE 2.—Fourth lower premolar of *Ammodon Leidyannum*, Marsh. One-half natural size.

FIGURE 3.—Last lower molar of same species. Also one-half natural size.

FIGURE 4.—Last lower molar of *Ammodon bathrodon*, Marsh. One-half natural size.

PLATE X.

FIGURE 1.—Last upper molar of *Perchærus antiquus*, Marsh. Natural size.

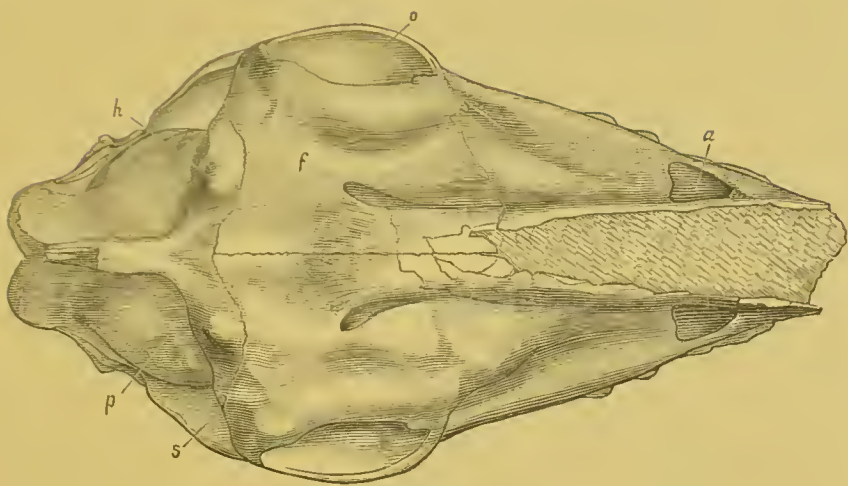
FIGURE 2.—Left lower jaw of *Colodon luxatus*, Marsh; side view. One-half natural size.

FIGURE 3.—The same jaw; seen from above.

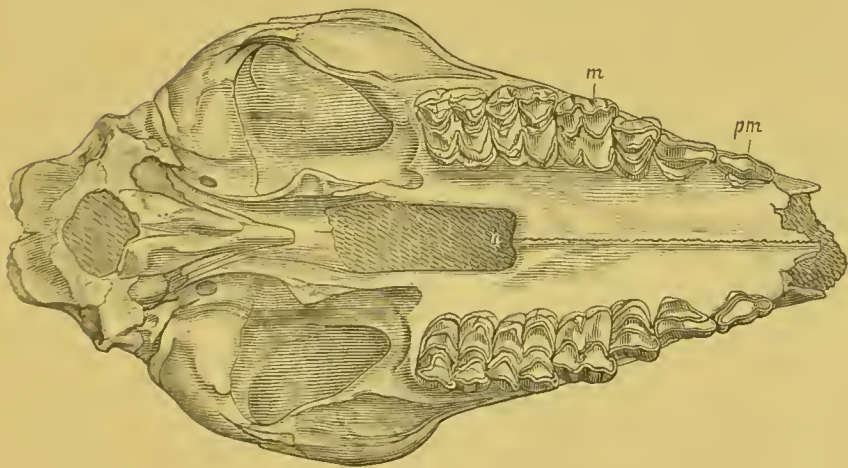
FIGURE 4.—Last lower molar of *Rhinoceros matutinus*, Marsh. One-half natural size.

FIGURE 5.—Portion of lower jaw of *Laopithecus robustus*, Marsh. Natural size.

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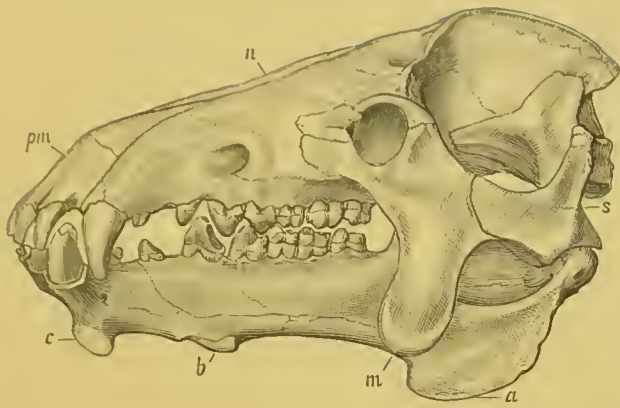
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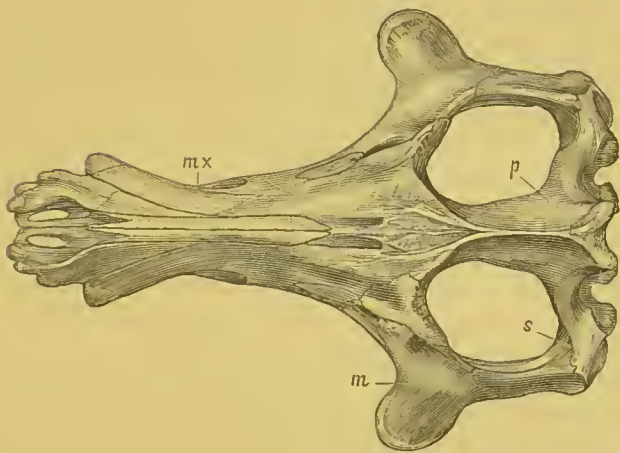
PROTOCERAS CELER, Marsh.



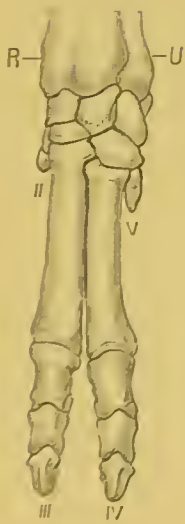
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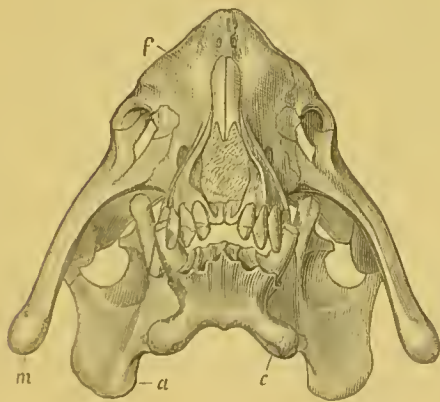
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3.



5.



ELOTHERIUM CRASSUM, Marsh.



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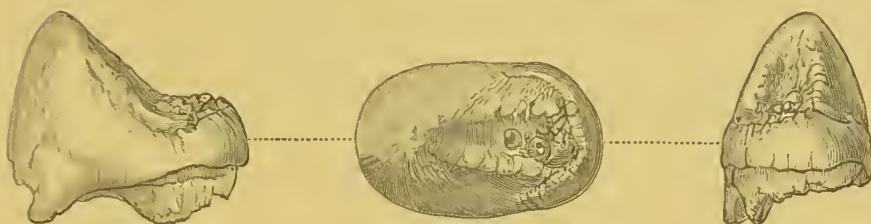


2.

a

b

c

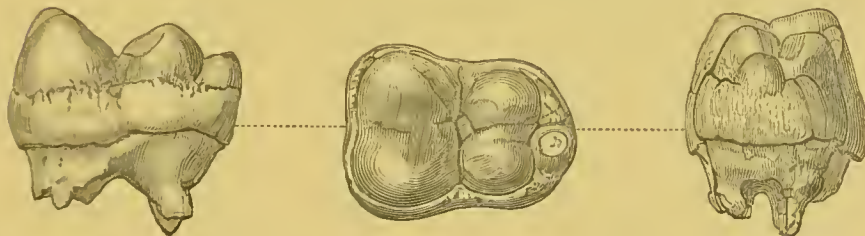


3.

a

b

c

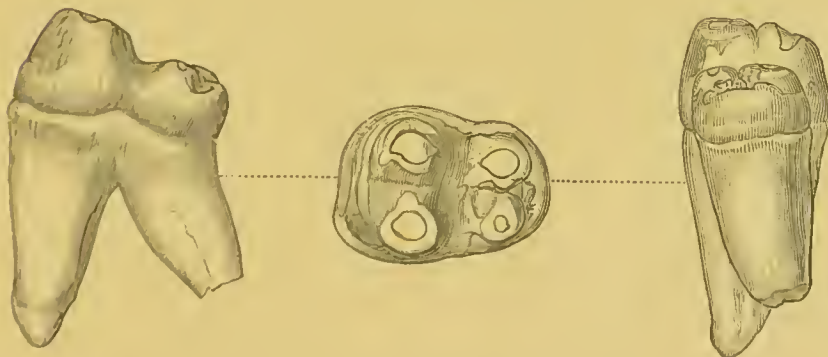


4.

a

b

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MIocene MAMMALIA.



1.



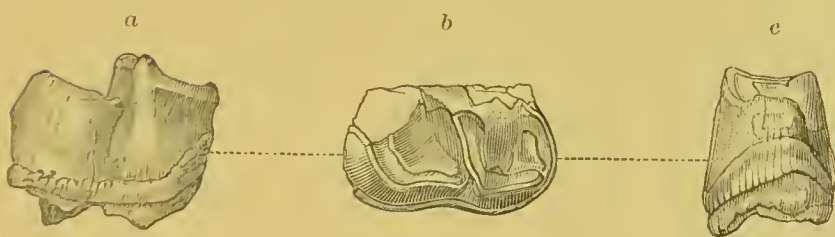
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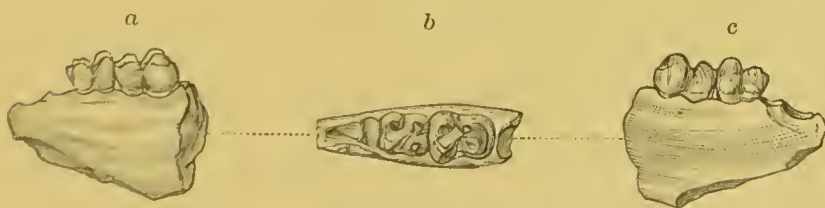
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MIocene MAMMALIA.

